mules, or the number present in particular cases, but it appears to me interesting to consider how far the theory will hold good when examined from this more physical point of view.

For the sake of argument, I assume that gemmules on an average contain one million structural molecules of albumen and molecularly combined water. Variations in number, composition, and arrangement would then admit of an almost infinite variety of characters. On this supposition it would require a thousand gemmules to be massed together into a sphere, in order to form a speck just distinctly visible with our highest and best magnifying powers. By calculation I find that a single mammalian spermatozoa might contain so many of such gemmules, that, if one were lost, destroyed, or fully developed in each second, they would not be completely exhausted until after the period of one month. Hence, since probably a number are concerned in producing perfect fertilisation, we can readily understand why the influence of the male parent may be very marked, even after having been, as regards particular characters, apparently dormant for many years.

In a similar manner I calculate that the germinal vesicle of a mammalian ovum might contain enough gemmules for one to be destroyed, lost, or fully developed in each second, and yet the entire number not be exhausted until after a period of seventeen years, and the entire ovum might contain enough to last at the same rate for no less than 5,600 years.

These calculations are made on the supposition that the entire mass is composed of gemmules. Of this there is little probability; but still, even if a considerable portion of the ovum consists of completely formed material and of mere nutritive matter, it might yet contain a sufficient number of gemmules to explain all the facts contemplated by the theory of pangenesis. The presence of any considerable amount of such passive matter in spermatozoa would, however, be a serious difficulty in the way of the theory, unless indeed very many spermatozoa are invariably concerned in producing fertilisation.

Taking everything into consideration, it does not appear to me that any serious objection can be raised against pangenesis when examined from a purely physical point of view, as far as relates to the inheritance of a very complex variety of characters by the first generation, though there would have been may serious difficulties to contend with, if the ultimate atoms of matter had been very much larger than is indicated by the properties of gases.

When we come to apply similar reasonings to the second or following generations, we are compelled, along with Darwin, to conclude that gemmules have the power of producing other gemmules more or less closely resembling themselves, and of being collected together in the sexual elements, since otherwise the number that could be transmitted in a dormant state for several generations would be far too small to meet the requirements of the case.

Conclusion.

In my remarks I have made no endeavour to conceal our present ignorance of many very important questions connected with my subject. Want of the requisite data necessarily imparts a speculative character to many of my conclusions; but perhaps there is no more fruitful source of knowledge than to see and feel how little is accurately known, and how much remains to be learned.

THE TUFTED DEER OF CHINA

AMONG the many most valuable additions which Mr. R. Swinhoe has made to our knowledge of Chinese zoology, there are none more important than his discoveries in the deer-tribe. The Water Deer of Shanghai (*Hydropotes inermis*), first described in 1870, is one of the most interesting of these. It is of small size, without horns of any kind, and with long canine teeth present in the males only. In outward appearance it in these respects closely resembles the Musk Deer. Its colour is light chestnut, and the hairy coat is harsh. It is called the *Ke* and the *Chang* by the Chinese. Sir Victor Brooke has demonstrated that its skull differs in important points from that of *Moschus*.

Still more recently, in 1874, Mr. Swinhoe has described another small deer from the mountains near Ningpo, of much the same size as *Hydropotes;* it also resembles that genus in being hornless and possessing large canine tusks in the males. Mr. Swinhoe, in the "Proceedings" of the Zoological Society (1874, p. 452), writes as follows:—"My friend and correspondent, Mr. A. Michie, wrote me a letter dated Shanghai, December 19, 1873, as follows:—'I send another note to overtake the mail, to tell you I have just found a new deer from the Ningpo country. It is a dark iron-grey or pepper-and-salt colour, like some Scotch terriers, with white tips to its ears, square-built (that is, straight back and pointed hip), with very short tail. On its forehead is a thick black mane, like the bristles of a boar. . . . It has the lachrymal sinus, but not so large as the Muntjac; in size the beast about equals the Muntjac.'" An excellent figure accompanies this description. It was drawn from a skin sent by Mr. Michie to Mr. Swinhoe, who has named the animal *Lophotragus michianus.*

A living example of this species, the first ever brought to this country, has just reached the Zoological Gardens in Regent's Park. From this male specimen it can be seen that the drawing above referred to, made from the flat skin, excellently represents the figure of the animal, and is truthful in that it shows the canine teeth and the absence of horns. In the living specimen there is a pair of hair-covered tuberosities on the frontal regions, at the postero-lateral angles of the hairy head-tuft, but, as in the Giraffes, these have no horns upon them. Comparing this condition with that of *Elaphodus cephalophus*, also from China, described by M. A. Milne-Edwards, the intimate relation of *Lophotragus* to the Muntjacs (*Cervulus*) is evident; the series of gradual antler-reduction being in the following order:—*Cervulus*, *Elaphodus*, *Lophotragus*. Whether *Hydropotes*, or *Moschus*, or both are extremes of this series, remains to be proved; and it must be mentioned that it is not perfectly certain, though highly probable, that the above-described individual specimen of *Lophotragus* exhibits its highest degree of antler-development.

NOTES

SOME weeks since it was stated that the collection of fishes made by Mr. Francis Day, Inspector-General of Indian Fisheries, would be deposited in the New Indian Museum at South Kensington. It was offered to and accepted by the Secretary of State for India, but it was subsequently considered that neither the expense of bottles in which to exhibit them, nor of spirit for their preservation, could be rightly debited to the resources of India. Mr. Wood, the well-known artist, very liberally proposed, in exchange for the type collection, numbering about 1,200 species, to increase Mr. Day's plates in his work, the "Fishes of India," from 160 to 190, or to 1,140 figures. The Director of the Indian Museum in Calcutta hearing of this arrangement, proposed to the trustees that he should secure it at once on these terms, and we understand that he has been instructed to do so. It will doubtless render the Museum in Calcutta the most complete in Indian fishes in the world; but whether this collection finding a place in the British Museum might not have proved more beneficial to science we leave for the decision of our readers.

MR. WILLETT has just issued a report on the Sub-Wealden boring, stating that the bore-hole has been widened and lined to a depth of 1,760 feet, and that boring was recommenced on the 8th inst. at a depth of 1,825 feet, when the hard limestone passed into soft shales, and mentions the occurrence of imperfect specimens of ammonites, at 1,849 feet. Geologists will probably not be disposed to agree with Mr. Willett, "that the theory of the presence of a ridge of old rocks north of the English Channel and south of the Thames is no longer tenable," for we believe that no one ever denied that the Wealden axis was "a true anticlinal elevation." In stating that the Cretaceous rocks are the same thickness on both sides of the axis, Mr. Willett appears to forget that the old Palæozoic rocks were contorted and their upturned edges denuded, before the Secondary rocks, much less the Tertiary, were deposited, and in stating that the 1,800 feet of strata, explored by the boring, as well as the overlying beds, were "deposited during a prolonged and continuous subsidence of this part of the earth's surface," we believe few men of science will coincide with him. In the conclusion of his report, he offers personally to bear the cost of any boring in Kent or Sussex, above the Wealden horizon, which may reach the Palæozoic rocks, within a depth of 2,000 feet.

In answer to Dr. Playfair on Monday, Mr. Cross said the recommendations of the Royal Commission for Scientific Instruction and the Advancement of Science had been for some time under the consideration of the Government. With reference to what steps the Government proposed to take in the matter, he would rather not anticipate, he said, the statement which it would be the duty of his noble friend the Vice-President of Council to make on the subject. We look forward with considerable interest to the statement which Lord Sandon has to make, and hope we shall not have long to wait for it.

Mr. Ward Hunt stated last Thursday in the House of Commons that Capt. Nares will send a sledge party down to the entrance of Smith's Sound in the spring of this year, if possible, with despatches, for the chance of a ship from England calling there. The Admiralty have arranged with Mr. Allen Young, who is contemplating a voyage to the Arctic regions this year in his yacht, to look for cairns in which such despatches might be deposited, and he has, with great public spirit, consented to make this the primary object of his voyage, undertaking to bring home any such despatches, unless he can find means for sending them to England otherwise.

A large and influential meeting of the citizens of Glasgow was held on Wednesday, Feb. 16, to make arrangements for the meeting of the British Association on Sept. 6. The Lord Provost presided. The University buildings were granted for the Association meetings. Most of the guarantee fund of 4,000*l.* was subscribed, and resolutions were adopted to extend the hospitality of the city to strangers attending the Association.

The death of the well-known French engineer, M. Thomé de Gamond, is just announced. M. de Gamond is probably best known as the originator of the Channel Tunnel, and he died on the very day on which the Commissioners took the final steps for the completion of that great work. He was born in 1798 at Paris, but was educated in the Netherlands, where he gave great attention to hydrography. His great scheme was remodelled by him many times before it took its final form. It was brought before several International Exhibitions and Commissions, and he published a great number of pamphlets, documents, and books before the scheme gained the favour of those who were able to help him in carrying it out. He was not destined to see the boring actually commenced, but he saw all obstructions and objections removed. M. Thomé de Gamond had also conceived a vast scheme for the improvement of the streams and rivers of France. He proposed to enable the country to utilise the whole of its hydraulic resources, and was anxious to put an end to the immense loss of water which might be used for irrigation and as a motive power. He was modest, energetic, and benevolent.

The death of M. Adolph Brogniart, Professor of Botany and Member of the French Academy of Sciences, was announced in Paris on Saturday.

Prof. Nils Peter Angelin, Intendent of the Palæontological Department of the Riks Museum, Stockholm, and author of "Palæontologia Scandinavica," died at Stockholm on the 13th inst., aged upwards of seventy years.

The death is announced of M. d'Orbigny, Assistant Naturalis at the Natural History Museum, Paris.

Herr von Loeher has recently read a paper before the Munich Academy of Sciences in which he argues that the Guanch or Wandsch population of the Canary Isles, who for more than a century repulsed all invaders, are the descendants of the Vandals. Most of the names of places are barbarian, but some Germanic. Many common expressions are a mixture of both, and names of persons are almost Germanic, as also religious phrases and the titles of public functionaries. Herr Loeher believes that the Vandals or Goths settled in the Isles in the eighth century, finding there a weak barbarian population whom they subjugated, that they gradually lost the use of iron and shipbuilding, and mostly relapsed from Christianity into German heathenism, but, though degenerating in their complete isolation, retained the features and customs of their race in all essential points until their discovery by Europeans. Fair-haired mummies have been found in their tombs, and the dimensions of the skulls agree with those of Germanic races.

In a letter to the Vice-Chancellor of Oxford, Prof. Max Müller expresses his great gratification with the decree passed in Convocation on Tuesday week. "It was solely," he says, "in order to secure the leisure necessary for the completion of my labours connected with the ancient literature of India that I came to the decision to resign my professorship. Now that you have in so generous a way granted me that leisure, I look forward with great satisfaction to spending the remaining years of my life at Oxford, and, if my health be spared, I still hope to be able to prove to the members of the University that they have bestowed this privilege on one not quite unworthy of their confidence."

A magnificent new map of France has recently been completed by the French Engineering Department, and is now being published in sheets. It is on the scale of 1·500000, and must take the place of all previous maps, most of which are, we believe, inaccurate in many important particulars. By means of various easily understood devices, the new map shows all the main natural and artificial features of the country, and by means of its metrical divisions, the distances of places from each other may be observed at a glance.

A very interesting museum will be opened in a few weeks at the village of Castleton, in the Peak of Derbyshire, a place much visited by geologists, &c. It will contain: (*a*) a series of articles of the Bronze and Neolithic periods from Switzerland, Denmark, Cissbury, Yorkshire, with a large number of the prehistoric remains from the tumuli, &c., near Castleton, the result of the explorations of Mr. Rooke Pennington, F.G.S., and Mr. John Tym during the last few years. (*b*) Palæolithic implements. (*c*) A magnificent series of the Pleistocene animals of the Derbyshire district—bison, grizzly bear, reindeer, rhinoceros, hyæna, &c. (*d*) A good geological series, of about 1,500 species of fossils numbering about 3,500 specimens, from Crag to Laurentian, and including a good Ichthyosaurus, Plesiosaurus, Crag and Eocene mammals, some good fish, &c. Most of the formations are well represented, but particularly those prevailing near Castleton (mountain limestone, Yoredale series, and coal measures). (*e*) A series of minerals and rocks, the Derbyshire minerals being specially good; and some educational sets of fossils and minerals. All the above are properly arranged with explanatory notes, so as to be useful to the uninitiated and to teach geological rudiments, whilst affording advanced students opportunity of comparing their "finds" and naming them. (*f*) A series of the fauna and flora of North Derbyshire, including mammals (stuffed), birds, and their nests and eggs, ferns and mosses, &c. (*g*) Collection of old china, entirely obtained from the older houses in the neighbourhood, with old books, ornaments, coins, &c. (*h*) Set of archaic mining tools from the old lead mines of Castleton. (*j*) The natural and commercial productions of the neighbourhood. (*k*) Geological maps and sections, guide-books, and a small scientific reference library. Mr. Pennington's collections are all included in the museum.

THE investigation into the cause of the explosion at the Jabin pit, near Lyons, in France, seems to show that the workmen were not to blame for any imprudence in the use of their lamps, but that the catastrophe was probably produced by the inflammable air escaping from the coal beds by a great diminution of barometric pressure, which reached 10 millimetres in a few hours. This connection of explosions in mines with a diminution of barometric pressure has been frequently referred to recently in connection with explosions in England. The question has been asked whether it is not desirable to extend the system of storm warnings to coal-mining districts; if the miners could only be induced to attend to them there seems no doubt that a great saving of life would be thus effected.

A VALUABLE and in many respects exhaustive memoir on the temperature of the air at Brussels, by Prof. E. Quetelet, based on forty years' observations ending with 1872, appears in Vol. XLI. of the Memoirs of the Royal Academy of Belgium. The paper presents in a more extended and permanent form the leading features of the most important element of the climate of Brussels, which appeared about a year ago in the form of a small tract, briefly reviewed in NATURE at the time (vol. xi., p. 444).

MRS. MARSHALL HALL, sen., writes that the lady who made a successful ascent of Mont Blanc on the 31st ult., mentioned in our last number, was Miss Stratton, a Welsh lady, not an American.

AN apparatus of great delicacy has lately been devised by Dr. Mosso of Turin, for measuring the movements of the blood-vessels in man. A description of it, with figures, appears in *Comptes Rendus* of Jan. 24. The arrangement of the *plethysmograph* (as it is called) consists in enclosing a part of the body, the fore-arm, *e.g.*, in a glass cylinder with caoutchouc ring, filling the cylinder with tepid water, and measuring, by a special apparatus, the quantity of water which flows out or in through a tube connected with the cylinder, as the arm expands or contracts. An opening in the cylinder is connected by a piece of caoutchouc tubing with a glass tube opening downwards into a test tube suspended from a double pulley with counterpoise to which the recording lever is attached, in a vessel containing a mixture of alcohol and water. When the vessels of the arm dilate water passes from the cylinder into the test tube, which is thereby immersed further, so that the counterpoise rises; in the opposite case water flows back from the test-tube into the cylinder, the test-tube rises, and the counterpoise descends. Among other applications of the apparatus, Dr. Mosso employs it in studying the physiology of thought and cerebral activity. The slightest emotions are revealed by the instrument by a change in the state of the blood-vessels. The entrance of a person during the experiment, in whom one is interested, has the effect of diminishing the volume of the fore-arm four to fifteen cubic centimetres. The work of the brain during solution of an arithmetical or other problem, or the reading of a passage difficult to understand, is always accompanied by contraction of the vessels proportional to the effort of thought.

THE Perthshire Society of Natural Science has recently conferred a great benefit on the City of Perth by drawing attention through one of its members, Dr. Lauder Lindsay, to the many imperfections of its water-supply. Perth, as our readers know, stands on the banks of the finest river in the kingdom, and yet its water-supply is lamentably deficient in quantity and quality. The present system of supply was organised about fifty years ago, and Dr. Lindsay brought it to the test of the universally recognised principles of sanitary science, with the result stated. Unfortunately Perth lies very low, and on that very account unusual care must be taken to keep the supply of water pure. After the lesson which Dr. Lindsay has read the inhabitants, it will be their own blame if they do not exercise what would be genuine economy, and remedy a state of matters which must undoubtedly exercise a deleterious influence on the health and prosperity of the fair city. We think this practice of bringing science to bear on matters of local importance is one quite within the sphere of local scientific societies.

THE Meteorological Commission of Allier have now twenty regular meteorological stations at different heights, varying from 686 to 3,773 feet. These stations, together with eighty others for the observation of thunderstorms, have been established for the investigation of the local climates of the department. It is resolved by the Commission, in the interests of general meteorology, to connect its observations as much as possible with those which are collected at Paris.

THE additions to the Zoological Society's Gardens during the past week include a Bay Bamboo Rat (*Rhizomys badius*) from India, presented by Mr. Jas. Wood Mason; an Anderson's Kaleege (*Euplocamus andersoni*) from Burmah, two Hill Francolins (*Arboricola torqueola*) from India, presented by Mr. W. Jamrach; a Sociable Vulture (*Vultur auricularis*), two Cape Francolins (*Francolinus capensis*) from Africa, presented by Mr. J. C. Hobbs; two White-necked Storks (*Ciconia episcopus*) from India, received in exchange; two White-backed Pigeons (*Columba leuconota*) from the Himalayas, a Tiger Bittern (*Tigrisoma brasiliense*), five Geoffroy's Doves (*Peristera geoffroii*) from South America, purchased.

THE INDUSTRIAL APPLICATIONS OF OXYGEN[1]

II.

WE must now direct our attention to a small group of proposals for extracting oxygen from the air by purely mechanical means, without the aid of any chemical action. They are founded on one or other of two physical principles, diffusion or absorption.

T. Graham, whose "inquiries into the laws of the diffusion of gases" will always be remembered as one of the most perfect of his numerous and great researches, observed in 1866[2] that air drawn through a small fissure of a thin india-rubber leaf contains the constant proportion of 41·6 parts of oxygen to 58·4 parts of nitrogen, so that half of the nitrogen of the atmospheric air is kept back, and that this mixture makes red-hot coals burn with a flame. Deville,[3] however, tested this method with regard to its industrial merits, and found that it required too much time to be considered practical.

Endeavours to utilise absorption have been made in two different ways. Messrs. Montmagnon and De Laire obtained a patent in France in 1868 for a process, founded on the observations of Angus Smith,[4] according to which charcoal takes up more oxygen

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[1] Translated, by permission of the editor, from the "Report on the Development of Chemical Industry, in conjunction with friends and fellow-workers, by A. W. Hofmann." The present article, as well as the previous one, it should be understood, are by Dr. A. Oppenheim. Continued from p. 295.

[2] Graham, Compt Rend. lxiii, 471.

[3] Deville, Wagn. Jahresber., 1867, 216.

[4] Bull. Soc. Chim. [2], xi., 261.